Volume : 2 | Issue : 6 | June 2013 • ISSN No 2277 - 8160

Research Paper | Management

A Study about Foreign Exchange Economic Theory

Dr. K. Vimala — Asst Prof, Department of Management Studies, Dr M.G.R Educational & Research University, Maduravoyal, Chennai -95

Dr S. N Geetha — Prof. & Head, Department of Management Studies, Anna University, Chennai

ABSTRACT

The exchange rate is a key financial variable that affects decisions made by foreign exchange investors, exporters, importers, bankers, businesses, financial institutions, policymakers and tourists in the developed as well as developing world. Exchange rate fluctuations affect the value of international investment portfolios, competitiveness of exports and imports, value of international reserves, currency value of debt payments, and the cost to tourists in terms of the value of their currency. Movements in exchange rates thus have important implications for the economy's business cycle, trade and capital flows and are therefore crucial for understanding financial developments and changes in economic policy.

KEYWORDS: Exchange Rate Policy, Cash Flow Models, Interventions, Macro Economics Fundamental

Introduction

Forex is a commonly used abbreviation for "foreign exchange". It typically describes the buying and selling of currency in the foreign exchange market, especially by investors and speculators. The familiar expression, "buy low and sell high," certainly applies to currency trading. A forex trader purchases currencies that are undervalued and sells currencies that are overvalued; just as stock trader purchases stock that is undervalued and sells stock that is overvalued.

Exchange Rates and Exchange Rate Policy in India: A Review

India's exchange rate policy has evolved over time in line with the gradual opening up of the economy as part of the broader strategy of macroeconomic reforms and liberalization since the early 1990s. In the post independence period, India's exchange rate policy has seen a shift from a par value system to a basket-peg and further to a managed float exchange rate system. With the breakdown of the Bretton Woods System in 1971, the rupee was linked with pound sterling. In order to overcome the weaknesses associated with a single currency peg and to ensure stability of the exchange rate, the rupee, with effect from September 1975, was pegged to a basket of currencies till the early 1990s.

The initiation of economic reforms saw, among other measures, a two step downward exchange rate adjustment by 9 per cent and 11 per cent between July 1 and 3, 1991 to counter the massive draw down in the foreign exchange reserves, to install confidence in the investors and to improve domestic competitiveness. The Liberalised Exchange Rate Management System (LERMS) was put in place in March 1992 involving the dual exchange rate system in the interim period. The dual exchange rate system was replaced by a unified exchange rate system in March 1993. The experience with a market determined exchange rate system in India since 1993 is generally described as 'satisfactory' as orderliness prevailed in the Indian market during most of the period. Episodes of volatility were effectively managed through timely monetary and administrative measures.

An important aspect of the policy response in India to the various episodes of volatility has been market intervention combined with monetary and administrative measures to meet the threats to financial stability while complementary or parallel recourse has been taken to communications through speeches and press releases. In line with the exchange rate policy, it has also been observed that the Indian rupee is moving along with the economic fundamentals in the post-reform period. Moving forward, as India progresses towards full capital account convertibility and gets more and more integrated with the rest of the world, managing periods of volatility is bound to pose greater challenges in view of the impossible trinity of independent monetary policy, open capital account and exchange rate management. Preserving stability in the market would require more flexibility, adaptability and innovations with regard to the strategy for liquidity management as well as exchange rate management. With the likely turnover in the foreign exchange market rising in future, further development of the foreign exchange market will be crucial to manage the associated risks. The following trend in exchange rate reveals that the need to understand the exchange rate theories and its impact in the economic growth.

Historical Indian Rupee Rate (INR USD)

Year	INR/USD	Year	INR/USD	Year	INR/USD	Year	INR/USD
1973	7.66	1984	11.36	1995	32.43	2006	45.17
1974	8.03	1985	12.34	1996	35.52	2007	41.20
1975	8.41	1986	12.60	1997	36.36	2008	43.41
1976	8.97	1987	12.95	1998	41.33	2009	48.32
1977	8.77	1988	13.91	1999	43.12	2010	45.65
1978	8.20	1989	16.21	2000	45.00	2011	46.61
1979	8.16	1990	17.50	2001	47.23	2012	53.34
1980	7.89	1991	22.72	2002	48.62		
1981	8.68	1992	28.14	2003	46.60		
1982	9.48	1993	31.26	2004	45.28		
1983	10.11	1994	31.39	2005	44.01		

Average annual currency exchange rate for the Indian Rupee (Rupees per U.S. Dollar) is shown in this table: 1973 to present.

The exchange rate of the Indian rupee (or INR) is determined by market conditions. However, in order to maintain effective exchange rates, the RBI actively trades in the USD/INR currency market. The rupee currency is not pegged to any particular foreign currency at a specific exchange rate. The RBI intervenes in the currency markets to maintain low volatility in exchange rates and remove excess liquidity from the economy

1. Exchange Rate Models: Theoretical Considerations

(i) Theory: Purchasing Power Parity, Monetary and Portfolio Balance Models

The earliest and simplest model of exchange rate determination, known as the Purchasing Power Parity (PPP) theory, represented the application of "the law of one price". This states that arbitrage forces will lead to the equalization of goods prices internationally once the prices are measured in the same currency. PPP theory provided a point of reference for the long-run exchange rate in many of the modern exchange rate theories. It was observed initially that there were deviations from the PPP in short-run, but in the long-run, PPP holds in equilibrium. However, many of the recent studies like **Jacobson, Lyhagen, Larsson and Nessen (2002)** find deviations from PPP even in the long-run. The reasons for the failure of the PPP have been attributed to heterogeneity in the baskets of goods considered for construction of price indices in various countries, the presence of transportation cost, the imperfect competition in the goods market, and the increase in the volume of global capital flows during the last few decades which led to sharp deviation from PPP.

The Harrod Balassa Samuelson Model rationalized the long run deviations from PPP. According to this model, productivity differentials are important in explaining exchange rates. They relax PPP assumption and allow real exchange rates to depend on relative price of non-tradable which are a function of productivity differentials. **Chinn (1999) and Clostermann and Schnatz (2000)** find that a model with

productivity differentials, better explains and forecasts exchange rate behaviour.

The failure of PPP models gave way to Monetary Models which took into account the possibility of capital/bond market arbitrage apart from goods market arbitrage assumed in the PPP theory. In the monetary models, it is the money supply in relation to money demand in both home and foreign country, which determine the exchange rate. The prominent monetary models include the flexible and sticky-price monetary models of exchange rates as well as the real interest differential model and Hooper-Morton's extension of the sticky-price model. In this class of asset market models, domestic and foreign bonds are assumed to be perfect substitutes.

The Flexible-Price Monetary Model **(Frenkel, 1976)** assumes that prices are perfectly flexible. Consequently, changes in the nominal interest rate reflect changes in the expected inflation rate. A relative increase in the domestic interest rate compared to the foreign interest rate implies that the domestic currency is expected to depreciate through the effect of inflation which causes the demand for the domestic currency to fall relative to the foreign currency. In addition to flexible prices, the model also assumes uncovered interest parity, continuous purchasing power parity and the existence of stable money demand functions for the domestic and foreign economies.

The model further implies that an increase in the domestic money supply relative to the foreign money supply would lead to a rise in domestic prices and depreciation of the domestic currency to maintain PPP. Further, an increase in domestic output would lead to an appreciation of the domestic currency since an increase in real income creates an excess demand for domestic money supply. This, in turn, causes a reduction in aggregate demand as agents try to increase their real money balances leading to a fall in prices until money market equilibrium is restored.

Frankel (1979) argued that a drawback of the **Dornbusch (1976)** formulation of the sticky-price monetary model was that it did not allow a role for differences in secular rates of inflation. He develops a model that emphasizes the role of expectation and rapid adjustment in capital markets. The innovation is that it combines the assumption of sticky prices with that of flexible prices with the assumption that there are secular rates of inflation. This yields the real interest differential model.

Hooper and Morton (1982) extend the sticky price formulation by incorporating changes in the long-run real exchange rate. The change in the long-run exchange rate is assumed to be correlated with unanticipated shocks to the trade balance. They therefore introduce the trade balance in the exchange rate determination equation. A domestic (foreign) trade balance surplus (deficit) indicates an appreciation (depreciation) of the exchange rate.

The four models discussed above can be derived from the following equation specified in logs with starred variables denoting foreign counterparts:

$$e_t = \gamma + \delta(m_t - m_t^*) + \phi(y_t - y_t^*) + \alpha(i_t - i_t^*) + \beta(\pi_t - \pi_t^*) + \eta(tb_t - tb_t^*) + \mu_t$$

where e = price of foreign currency in domestic currency
m = money supply
y = real output
i = nominal interest rate
IT = inflation
tb = trade balance

The alternative testable hypotheses are as follows:

Flexible-price model:	$\delta>0, \alpha>0, \phi<0, \beta=\eta=0$
Sticky price model:	$\delta>0, \alpha<0, \phi<0, \beta=\eta=0$
Real interest differential model:	$\delta>0, \alpha<0, \phi<0, \beta>0, \eta=0$
Hooper-Morton model:	$\delta>0, \alpha<0, \phi<0, \beta>0, \eta<0$

These models can be further extended to incorporate portfolio choice between domestic and foreign assets. The portfolio balance model assumes imperfect substitutability between domestic and foreign assets. It is a dynamic model of exchange rate determination that allows for the interaction between the exchange rate, current account and the level of wealth. For instance, an increase in the money supply is expected to lead to a rise in domestic prices. The change in prices, in turn, can affect net exports and thus imply changes in the current account of the balance of payments. This, in turn, affects the level of wealth (via changes in the capital account) and consequently, asset market and exchange rate behaviour. Under freely floating exchange rates, a current account deficit (surplus) is compensated by accommodating transactions in the capital account i.e. capital account surplus (deficit). This has implications for the demand and supply of currency in the foreign exchange market, which can lead to appreciation (depreciation) of the exchange rate. Thus the coefficient of the current account differential in the exchange rate model is hypothesized to have a positive sign. The portfolio approach thus introduces current account in the exchange rate equation. The theoretical model can be expressed as a hybrid model as follows:

$$e_t = \gamma + \delta(m_t - m_t^*) + \phi(y_t - y_t^*) + \alpha(i_t - i_t^*) + \beta(\pi_t - \pi_t^*) + \eta(tb_t - tb_t^*) + \theta(ca_t - ca_t^*) + \mu_t$$

where ca denotes current account balance and $\theta > 0$

(ii) Theory: Capital flows, forward premium

With an increase in liberalization and opening up of capital accounts the world over, capital flows have become important in determining exchange rate behaviour. The relation between capital flows and exchange rates is hypothesized to be negative (with the exchange rate defined as the price of foreign currency in domestic currency). This is because capital inflow implies purchase of domestic assets by foreigners and capital outflow as purchase of foreign assets by residents. Since the exchange rate is determined by the supply and demand for foreign and domestic assets, the purchase of foreign assets drives up the price of foreign currency. Likewise, the purchase of domestic assets drives up the price of domestic currency. Thus, an increase in capital inflows leads to appreciation of the domestic currency when there is no government intervention in the foreign exchange market or if there is persistent sterilized intervention. In the case of unsterilized government intervention, the potential of capital inflows to influence exchange rates decreases to a great extent.

Dua and Sen (2009) develop a model which examines the relationship between the real exchange rate, level of capital flows, volatility of the flows, fiscal and monetary policy indicators and the current account surplus, and find that an increase in capital inflows and their volatility lead to an appreciation of the exchange rate. The theoretical sign on volatility can, however, be positive or negative.

The forward premium measured by the difference between the forward and spot exchange rate can provide useful information about future exchange rates. According to covered interest parity, the interest differential between two countries equals the premium on forward contracts. Thus, if domestic interest rates rise, the forward premium on the foreign currency will rise and the foreign currency is expected to appreciate. The exchange rate defined as the price of foreign currency in domestic currency and the forward premium are therefore expected to be positively related.

(iii) Theory: Microstructure Framework

The microstructure theory of exchange rates provides an alternative view to the determination of exchange rates. Unlike macroeconomic models that are based on public information, micro-based models suggest that some agents may have access to private information about fundamentals or liquidity that can be exploited in the short-run. In microeconomic models of asset prices, transactions play a causal role in price determination (Evans and Lyons, 2001, 2007). The causal role arises because transactions convey information that is not common knowledge. These models assume that information is dispersed and heterogeneous agents have different information sets. The trading process in foreign exchange markets is not transparent and features bid-ask spreads that reflect the costs to market makers / dealers of processing orders and managing inventories. Thus, a distinctive feature of the microstructure models is the central role played by transactions volume or order flows in determining nominal exchange rate changes (Medeiros, 2005; Bjonnes and Rime 2003).

Order flow is the cumulative flow of transactions, signed positively or negatively depending on whether the initiator of the transaction is buying or selling. Order flow takes positive values if the agent purchases foreign currency from the dealer and takes negative values if it sells at the dealer's bid. Conventionally, order flow is taken as purchase

minus sales of foreign currency. Hence an increase in order flow (i.e. an increase in the volume of positively signed transactions) will generate forces in the foreign exchange market such that there is pressure on the domestic exchange rate to depreciate. Hence the order flow and the exchange rate are positively related. The explanatory power or information content of order flow depends on the factors that cause it. Order flow is most informative when it is caused due to dispersion of private information amongst agents with respect to macroeconomic fundamentals (Evans and Lyons, 2005). Order flow is less informative when it is caused due to management of inventories by the foreign exchange dealers in response to liquidity shocks.

If the dealers of foreign exchange are heterogeneous and have different information sets, then there is information asymmetry in the foreign exchange market. In this case, order flow will capture the reaction of the market (obtained from aggregating the different reactions of the dealers having different information sets) to changes in macroeconomic fundamentals and news related to changes in economic conditions. As macroeconomic fundamentals change, future expectations of the dealers of foreign exchange also change and so they adjust their portfolio of foreign currency accordingly, leading to a change in exchange rates. Another aspect of micro structure theory that has drawn attention is the liquidity effect of order flow. Studies in the literature have empirically tested whether the relationship between order flow and exchange rates is due to liquidity effects that are temporary in nature such as the herding behaviour of foreign exchange dealers (Breedon and Vitale 2004).

(iv) Theory: Intervention

Intervention by the central bank in the foreign exchange market also plays an important role in influencing exchange rates in countries that have managed floating regime. With the growing importance of capital flows in determining exchange rate movements in most emerging market economies, intervention in foreign exchange markets by central banks has become necessary from time to time to contain volatility in foreign exchange markets.

The motive of central bank intervention may be to align the current movement of exchange rates with the long-run equilibrium value of exchange rates; to maintain export competitiveness; to reduce volatility and to protect the currency from speculative attacks. Many studies in the literature including Edison (1993), Dominguez and Frankel (1993), Almenkinders (1995) and more recently Sarno and Taylor (2001) and Neely (2005) survey the literature on modelling the reaction function of the central bank and assessing the effectiveness of intervention.

Intervention is of two types - sterilised and non-sterilised. Intervention is sterilised if the sale or purchase of foreign currency is accompanied by expansionary or contractionary open market operations, so that domestic money supply is insulated from the effects of foreign exchange sale/purchase. Intervention is unsterilised if the sale or purchase of foreign currency is not accompanied by offsetting open market operations. The impact of sterilised and unsterilised intervention on exchange rates can be quite different.

In case of non-sterilised intervention, say, purchase of foreign exchange (to prevent appreciation) not accompanied by contractionary open market operations, money supply increases, which reduces the rate of interest and increases demand. This leads to capital outflow on one hand and an increase in import demand on the other. All this leads to an increase in the demand for foreign currency and hence the exchange rate depreciates. Thus non-sterilised intervention and exchange rates are positively related.

While non-sterilised intervention directly influences the exchange rate through the monetary channel, sterilised intervention also influences exchange rate through different channels - by changing the portfolio balance, through the signaling channel where sterilised purchase of foreign currency will lead to a depreciation of the exchange rate if the foreign currency purchase is assumed to signal a more expansionary domestic monetary policy and more recently, the noise-trading channel, according to which, a central bank can use sterilised interventions to induce noise traders to buy or sell currency. Hence the overall effect of sterilised intervention on exchange rates is ambiguous.

Kletzer and Kohli (2001) develop a theoretical model and discuss the role of financial repression in exchange rate management in the Indian context. They find that policy instruments of financial repression can be used as tools for exchange rate intervention under managed float.

Recognizing the importance of both monetary models as well as micro structure theory in determining the exchange rates, the study uses a combination of both the models. Exchange rate is determined by monetary variables as well as order flows. Theory has been further expanded to include forward premia, capital inflows, volatility of capital flows and central bank intervention as determining the exchange rate behaviour. The theoretical model so generated can be expressed as follows:

$$e_t = \gamma + \delta(m_t - m_t^*) + \phi(y_t - y_t^*) + \alpha(i_t - i_t^*) + \beta(\pi_t - \pi_t^*) + \eta(tb_t - tb_t^*) + \theta(ca_t - ca_t^*) + \nu cap_t + \rho vol_t + \omega fdpm_t + \psi of_t + \xi int_t + \mu_t$$

where cap_t = capital inflow
vol_t = volatility of capital flows
$fdpm_t$ = 3-month forward premia
of_t = order flow
int_t = central bank intervention

The additional signs are as follows: $\theta>0$; $\nu<0$; $\rho>$or<0; $\omega>0$; $\psi>$or<0; and $\xi>$or<0. The expected signs can be summarized as follows:

Expected Signs of Independent Variables
Dependent Variable: e_t
(price of foreign currency in terms of domestic currency)

Variables	Expected Sign
i_t-i_t^*	+/-
y_t-y_t^*	-
m_t-m_t^*	+
π_t-π_t^*	+
tb-tb*	-
ca-ca*	+
$fdpm_t$	+
$capflow_t$	-
vol_t	+/-
of_t	+/-
int_t	+/-

Conclusion

In sum, several exchange rate models available in the literature have been tested during the last two and a half decades. No particular model seems to work best at all times/horizons. Monetary models based on the idea of fundamental driven exchange rate behaviour work best in the long-run, but lose their predictability in the short-run to naïve random walk forecasts. The volatility of exchange rates also substantially exceeds that of the volatility of macroeconomic fundamentals, thus providing further evidence of weakening fundamental-exchange rate link.

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